

R E P O R T R E S U M E S

ED 015 750

JC 670 965

TRAINING NUCLEAR TECHNICIANS.

BY- KOVNER, EDGAR A.

PUB DATE MAR 67

EDRS PRICE MF-\$0.25 HC-\$0.24 4P.

DESCRIPTORS- \*JUNIOR COLLEGES, \*TECHNICAL EDUCATION, PROGRAM PLANNING, PROGRAM DESCRIPTIONS, ENGINEERING TECHNICIANS, NUCLEAR PHYSICS, ELECTRONICS, ELECTRONIC TECHNICIANS, OLD DOMINION COLLEGE,

PROBLEMS CONFRONTED BY PLANNERS OF NUCLEAR PROGRAMS AT THE TECHNICIAN LEVEL INCLUDE (1) LACK OF PRECEDENT IN CURRICULUM, COURSE OUTLINES, AND GRADUATE PLACEMENT, (2) DIFFICULTY IN DETERMINING COSTS OF LABORATORY CONSTRUCTION, EQUIPMENT, AND OPERATION, AND (3) REQUIREMENT OF ATOMIC ENERGY COMMISSION LICENSES IN NUCLEAR OCCUPATIONS. A 92-SEMESTER UNIT PROGRAM DEVELOPED AT THE COMMUNITY COLLEGE DIVISION OF OLD DOMINION COLLEGE COMBINES NUCLEAR COURSES WITH A STRONG BASE IN ELECTRONICS. THE PROGRAM, WHICH IS OPEN ONLY TO HIGH SCHOOL GRADUATES WHO HAVE COMPLETED ELEMENTARY AND INTERMEDIATE ALGEBRA, PLANE GEOMETRY, AND CHEMISTRY, INCLUDES ENGLISH AND TECHNICAL WRITING, SOCIAL STUDIES, MATHEMATICS, PHYSICS, ELECTRICITY AND ELECTRONICS, NUCLEAR STUDIES, OTHER TECHNICAL COURSES, AND PHYSICAL EDUCATION. LISTS OF MAJOR EQUIPMENT AND A PROGRAM OUTLINE ARE PROVIDED IN THE ARTICLE. THIS ARTICLE IS PUBLISHED IN "SCHOOL SHOP," VOLUME 26, NUMBER 7, MARCH 1967. (WO)

**Proof of this program's effectiveness  
is its graduate-placement record**

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE  
OFFICE OF EDUCATION

ED015750

# Training

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

## Nuclear

## Technicians

UNIVERSITY OF CALIF.  
LOS ANGELES

NOV 17 1967

By Edgar A. Kovner

CLEARINGHOUSE FOR  
JUNIOR COLLEGE  
INFORMATION

*Dean, Community College Division,  
Old Dominion College, Norfolk, Virginia*

**T**HE introduction of a nuclear program at the engineering-technology level is a project not to be undertaken too lightly. There is very little precedent available as a guide in the area of curricular content, course outlines, and graduate placement. Expense of laboratory construction, equipment, and operation is difficult to ascertain. Then there arises the further requirement of Atomic Energy Commission licenses in the various nuclear operations.

Nevertheless, that these problems have been effectively surmounted is at-

tested to by the following record of success achieved by the Community College Division of Old Dominion College in its nuclear-option program in electronic-engineering technology directed by J. Hirst Lederle:

April 27, 1962: Circulated letter to industry describing proposed curriculum and soliciting comments.

July 25, 1962: Submitted initial proposal for AEC grant.

May 20, 1963: Received \$10,000 grant.

July 2, 1963: Requested Special Nuclear

Material License from AEC.

July 30, 1963: Received Special Nuclear Material License.

September 18, 1963: Accepted first students in new Nuclear Option. In addition, several second-year students transferred to the new program.

February 1, 1964: Applied for Byproduct Material License from AEC.

February 28, 1964: Received Byproduct Material License.

August 12, 1964: Graduated initial class.

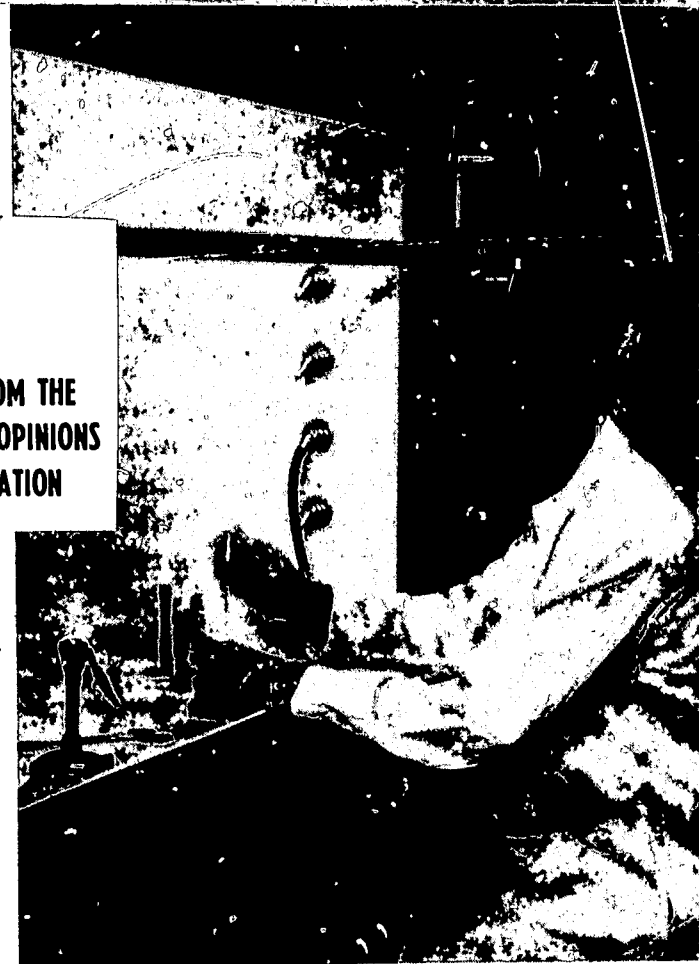
Supervised by an instructor, students here remove a sample from the neutron howitzer with the neutron source in the safe-storage position. Simultaneously, survey meter is monitoring for excessive neutron leakage.



Pursuing a procedure used extensively in industry, this student is operating a 400-channel analyzer with scintillation detectors to obtain data for accurately plotting the gamma spectrum of a radioactive sample.



Old Dominion nuclear-technology trainee prepares a radioactive sample protected by laboratory's special fume-control installation. Note use of plastic gloves to avoid contamination.



As for the professional acceptance accorded our graduates, consider this partial listing of their present whereabouts:

- Five are employed in the Submarine Reactor Plant Department, Atomic Power Division, Newport News Shipbuilding and Dry Dock Company, Virginia's largest industry.

- At the Virginia Associated Research Center, the operator of the 600-mev synchro-cyclotron (and author of its operating manual) is one of our graduates. Two others (including one serving as a full-fledged reactor operator) are with the Sandia Corporation, Albuquerque, N.M., still another is with the Goddard Project, Greenbelt, Md.

- A 1966 graduate is an associate engineer in the Reactor Systems Department of the Nuclear Engineering Division, Martin-Marietta Company, Baltimore, Md. His initial assignment

concerns the design of process-instrumentation systems for isotope production facilities and reactor systems.

- The Consultants Engineering Science Division of the Flow Corporation, Fort Belvoir, Va., utilizes one of our graduates to assist in its studies of radiation hazards. And three others are presently pursuing additional advanced technical study.

#### Drafting and Refining the Program

When the possibility of introducing a program in the nuclear field was first being considered, it was decided at the outset to combine the nuclear courses with a strong base in electronics because of the interrelationship of the two fields. A proposed curriculum was drawn up and it received favorable comment and suggestions for improvement from industry.

The curriculum was further evaluated

in terms of the criteria established by the American Nuclear Society and the American Society for Engineering Education, and subsequently took its present shape (see accompanying tabular depiction).

Completion of this curriculum requires 92 semester credits, which are divided into the following general areas:

	Semester credits
English and technical writing	9
Social studies	9
Mathematics	14
Physics	8
Electrical and electronics	21
Nuclear	16
Other technical courses	13
Physical education	2
<b>Total</b>	<b>92</b>

#### Supporting Procedures, Considerations

The preparation of a grant proposal for the Atomic Energy Commission involved setting forth proposed course outlines, experiments, lists of equipment (including prices), projected student enrollments, faculty qualifications, and other pertinent information. (A very helpful *Guide for Submission of Proposals for Equipment Grants and Loan of Materials in Physical Sciences and Engineering* is now available from the Atomic Energy Commission.)

The granting of the various special licenses is predicated on the petitioning institution having the required qualified personnel and laboratory facilities. The license forms are relatively simple and self-explanatory, and are also available from the AEC.

Because of the rigorous courses required in the nuclear program, as indeed is the case throughout its engineering-technology programs, the Old Dominion Community College Division's Technical Institute accepts only those secondary-school graduates who have successfully passed courses in elementary algebra, intermediate algebra, plane geometry, and chemistry. The Technical Institute is accredited by the Southern Association of Colleges and Schools and is an affiliate member of the American Society for Engineering Education.

#### Laboratory Work, Equipment

The experimental work in the nuclear courses includes determination of Geiger tube characteristics, decontamination procedures, proportional counter operation, half-life determinations, calibration of protective equipment, range, scattering, and absorption of alpha and

(Please turn to page 75.)

Program Outline Nuclear Option, Electronic-Engineering Technology					
Semester			*C	L	S
1	Engl 101	Composition and literature	3	0	3
	Fine Arts	Elective	3	0	3
	Math 112	Topics in algebra	3	0	3
	Tech 100	Introduction to technology	0	2	1
	Tech 151	Electrical circuits	3	6	5
	P.E. 101	Physical education	0	3	1
			12	11	16
2	Engl 102	Composition and literature	3	0	3
	Math 113	Topics in trigonometry	3	0	3
	Phys 101	Elementary physics	3	3	4
	Tech 251	Electronics I	3	6	5
	P.E. 102	Physical education	0	3	1
			12	12	16
3	Phys 102	Elementary physics	3	3	4
	Tech 105	Analytic geometry and calculus	5	0	5
	Tech 252	Electronics II	3	6	5
			11	9	14
4	Engl 103	Technical writing	3	0	3
	Tech 106	Electronics calculus	3	0	3
	Tech 164	Graphics	1	6	3
	Tech 253	Pulse and digital circuits	2	3	3
	Tech 257	Servomechanisms	2	3	3
			11	12	15
5	Hist 111	Technology in history	3	0	3
	Tech 202	Industrial materials	2	3	3
	Tech 289	Power plants	2	3	3
	Tech 291	Nucleonics	3	3	4
	Tech 292	Environmental radiation	3	0	3
			13	9	16
6	Social Studies	Elective	3	0	3
	Tech 391	Radioisotope procedures	1	3	2
	Tech 392	Nuclear instrumentation	3	3	4
	Tech 393	Reactor technology	2	3	3
	Technical	Elective	2	3	3
			11	12	15

\*C=Class hours; L=Laboratory hours; S=Semester credit hours.



## Nuclear Technicians... from page 59

beta particles, gamma absorption coefficients, energy range changes, spectrum plotting, radioisotope tracing, analysis of decay, neutron detection, counting, absorption, and scattering, radioisotope preparation by neutron bombardment, statistical errors in radiation detection, and others.

As pointedly evidenced by several of the accompanying photographs, safety precautions are stressed throughout the program. This emphasis virtually encompasses a technology of its own, by reason of the supporting instrumentation and related instruction.

The laboratory equipment is valued at \$35,000 and includes the following:

- Energy analyzer training systems for use with either Geiger tubes or scintillation detectors.
- 400-Channel Analyzer System, including detector and teletypewriter read-out.
- Ratemeter training systems.
- Gas flow detectors.
- Beta-gamma survey meters.
- Neutron survey meters.
- Neutron howitzer with 2-curie Pu-Be neutron source.
- Cobalt-60 source (10 millicuries).
- Various small sources.
- Nuclear fume hood for radioisotope preparation.
- Assorted sample changers, dosimeters, x-y recorders, etc.
- Assorted chemical laboratory apparatus for nuclear work.

### Future Directions, General Prognosis

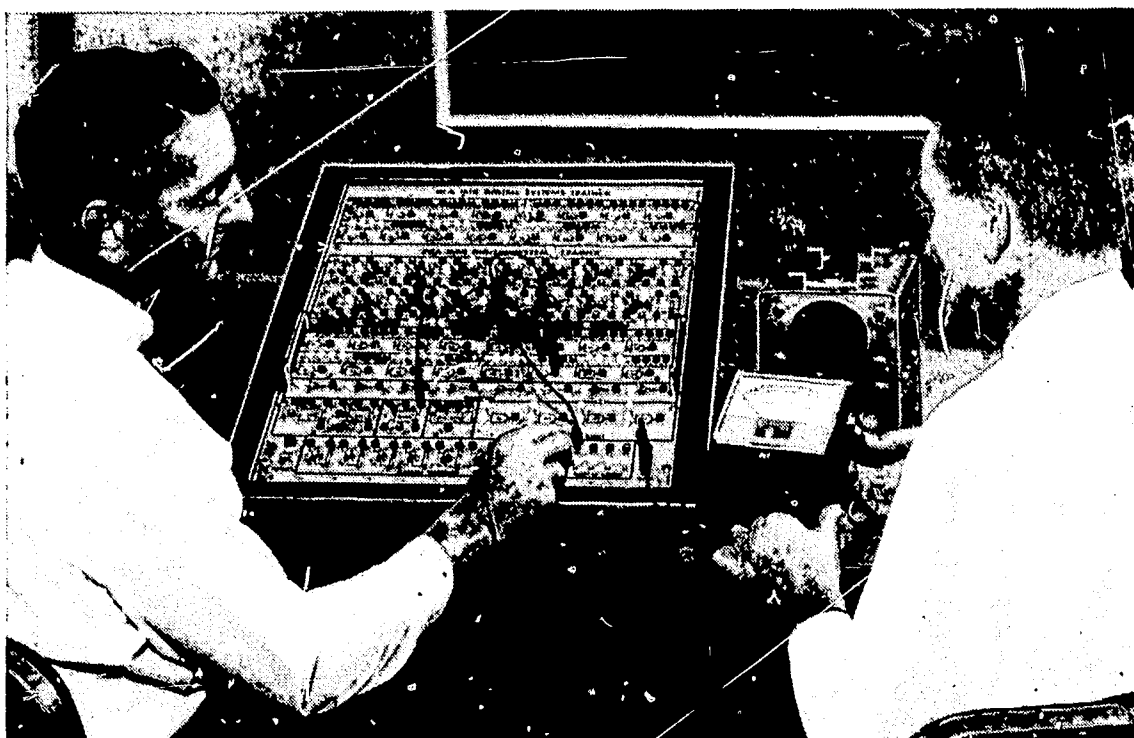
There are several signposts pointing to a rapid buildup in the demand and need for nuclear technicians of the type being trained at Old Dominion.

For example, with the cost of producing electricity by means of nuclear power plants approaching that of fossil fuel plants, the Atomic Energy Commission has asked Congress for permission to sell atomic fuel instead of leasing or renting it. In fact, when President Johnson told a college audience not too long ago that an "economic breakthrough" had been achieved in nuclear power, he thereby signalled the start of a race to produce sufficient nuclear engineers and technicians to meet the rapidly growing needs of both industry and the armed forces.

At Old Dominion, we feel we are in the vanguard of an inevitable move by technical institutes to bring adequate resources to bear on the preparation of youth for participation in the Nuclear Age.

In: School Shop, 26/58-59, March, 1967

## Computer processes taught thoroughly... learned completely—with THE RCA DIGITAL COMPUTER LOGIC SYSTEMS TRAINER



### A complete, versatile student laboratory for the study of Digital Computer Logic Principles.

The all solid-state Model 1600-DCS(A) is designed to enable students to construct and operate basic logic configurations that form the "heart" of digital computers. Students arrange and operate such typical circuits as up-counters, down-counters, ring counters, serial and parallel shift registers, parity checkers, error detectors, count recognition circuits, instruction decoders, and a nearly unlimited variety of logic configurations.

Students can operate circuits manually—one pulse at a time, or at various pulse rates under control of a multivibrator clock. The slow-motion feature of the "1600-DCS(A)" contrasts with the split-second processing of an actual computer which cannot be slowed down to study individual operations.

Two compact logic panels (17½" x 19" and 5¼" x 19") give students access to 16 flip-flop circuits, 16 "AND" gates, 16 "OR" gates, eight inverters and four "NAND" gates. Color-coded jacks, patch cords and plugs are provided for simplified circuit tracing and input-output identification. Prominent lines separate functional areas, and logic sym-

bols conform to MIL STD specification 806B.

For instructor demonstration, RCA has designed the Model 1700 Digital Computer Logic Systems Demonstrator. The Model 1700 is twice the size of the student model and has the full operational capability of the "1600-DCS(A)".

A comprehensive experiment guide and instruction manual prepared for the Models 1600-DCS(A) and 1700 respectively are supplied.

For complete information on RCA's versatile student laboratory trainers and instructor demonstrators, contact your RCA Electronic Trainer distributor, or mail the coupon in this advertisement.

RCA Electronic Trainers, Dept. Q67  
Bldg. 212, Camden, N. J. 08101  
Please send information on RCA's Digital Computer Logic Systems Trainer

Name \_\_\_\_\_  
Title \_\_\_\_\_  
School \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ Zip Code \_\_\_\_\_



The Most Trusted Name in Electronics

Circle No. 53 on Inquiry Card

# School Shop

**Editor and Publisher**  
Lawrence W. Prakken

**Managing Editor**  
Stanley J. Dean

**Associate Editor**  
Nancy O. Gouin

**Assistant Editors**  
Jerome Patterson  
Eloise R. Snyder

**Advertising Sales Manager**  
Roy A. Carpenter

**Advertising Production Manager**  
Dorothy J. Buffington

**Asst. Adv. Prod. Mgr.**  
Alice M. Louer

**Circulation Manager**  
Kenneth C. MacAdam

## EDITORIAL ADVISORY BOARD

**Lance C. Ash**, Director, Program Services Branch, Division of Vocational and Technical Education, U.S. Office of Education, Washington, D.C.  
**Gardner Boyd**, Director of Industrial Arts, School District of Kansas City, Missouri.

**George L. Brandon**, Head, Department of Vocational Education, Pennsylvania State University, University Park, Pennsylvania.

**Ray W. Dugger**, Vice-President, Texas A & M University, and Director, James Connolly Technical Institute, Waco, Texas.

**W. K. Dunton**, Assistant Superintendent, Vocational and Technical Education, Special School District of St. Louis County, Missouri.

**Ivan Hostetler**, Head (Retired), Industrial Arts Department, North Carolina State College, Raleigh.

**Harry Lewis**, Director, Trade and Technical Education, New York City Public Schools, New York.

**James C. O'Gara**, Supervisor of Industrial Education, Portland Public Schools, Oregon.

**George Parkinson**, Director, Milwaukee Vocational and Adult Schools, Wisconsin.

**Maurice W. Roney**, Director, School of Industrial Education, Oklahoma State University, Stillwater.

**Wesley P. Smith**, State Director of Vocational Education, California State Department of Education, Sacramento, California.

**Robert M. Werthington**, Assistant Commissioner, Vocational Education, New Jersey State Department of Education, Trenton, New Jersey.

## MEMBER OF

"PERMISSION TO REPRODUCE THIS  
COPYRIGHTED MATERIAL HAS BEEN GRANTED  
BY Prakken Publications  
Inc.

TO ERIC AND ORGANIZATIONS OPERATING  
UNDER AGREEMENTS WITH THE U.S. OFFICE OF  
EDUCATION. FURTHER REPRODUCTION OUTSIDE  
THE ERIC SYSTEM REQUIRES PERMISSION OF  
THE COPYRIGHT OWNER."

## CONTENTS

- The Pennsylvania Story** . . . . . John W. Struck 41  
Here's how a state went about ramrodding a vocational breakthrough.
- Flexible Scheduling for I-A** . . . . . Paul E. Powell and Norman Visca 44  
They freed up the schedule in a bid to provide "individualized" instruction.
- Up the Ladder to Industrial Insight** . . . . . Thomas P. Monaghan 46  
Step by step, students used this woodworking project to learn about mass-production.
- NYC's "Umbrella Project"** . . . . . Herman Slotkin 48  
Full employment and integration are the key objectives of this municipal program.
- Sugar 'n Spice Teams Up with Hammer 'n Saw** . . . . Robert Lento 50  
A short case history of one school's experience in opening I-A classes to girls.
- Using Diodes in Component Damage-Prevention** . . . . Jerold J. Simons 55  
Tips on how to use the diode as an "ounce of prevention" in circuitry projects.
- Training Nuclear Technicians** . . . . . Edgar A. Kovner 58  
Proof of this program's effectiveness is its graduate-placement record.
- Programed Safety for Junior-High Graphic Arts** . . . . Carl J. Hoffman 60  
Here's a ready-to-use set of materials designed to teach the ABC's of safety.
- The Key Is Mobility** . . . . . Chester W. Freed 62  
Old TV cabinets become mobile demonstration units in this author's junior-high shop.
- Hold-Down Bar for the Radial Arm Saw** . . . . . William P. Anderson 63  
Easier handling, extra precision, and improved safety stem from this kink.
- Improving the Parallel Clamp** . . . . . John Butala, Jr. 64  
Teaching the methodology of industrial design imparts added depth to I-A instruction.
- Drafting Models Make It Easy** . . . . . Worsley Fardy 65  
Three-dimensional wire mock-ups function as effective teaching aids.
- Creative Problem Solving** . . . . . James E. Seitz 66  
An overview of the needs and tactics for fostering industrial-education creativity.
- Pre-Service Training for T&I Teachers** . . . . . Leonard C. McDowell 70  
Kentucky launches an unorthodox assault on a familiar problem.

## REGULAR FEATURES

- |                                  |                                      |
|----------------------------------|--------------------------------------|
| School Shop Talk . . . . . 2     | Instructional Resources . . . . . 80 |
| News . . . . . 6                 | Out of the Past . . . . . 82         |
| In the Morning Mail . . . . . 19 | School Shop Kinks . . . . . 85       |
| The Technician . . . . . 30      | News from Industry . . . . . 88      |
| Speaking of Design . . . . . 75  | Index to Advertisers . . . . . 101   |
| Strictly Personal . . . . . 78   | From Washington . . . . . 102        |

March 1967



Prakken Publications

Vol. XXVI, No. 7

**Editorial and Business Offices:** Box 623, 416 Longshore Drive, Ann Arbor, Mich. 48107

**Manuscript Information:** Manuscripts are paid for an publication and should be addressed to the Editor, School Shop, Box 623, 416 Longshore Drive, Ann Arbor, Mich. 48107

**Subscription Rates:** \$4.00 a year, \$7.00 for two years, \$9.00 for three years; Canadian, \$4.00 a year; foreign, \$5.00 a year. Single copies 40 cents each except April, which is \$1.00. Special group rate for students in teacher-training institutions will be given on application.

**Publication Information:** Published monthly, September through June at Chicago, Illinois. Printed in the United States of America. Copyright 1967 by Prakken Publications, Inc. Member, Business Publications Audit, Inc.

**Advertising Sales Offices:**

Ann Arbor, Mich. 48107—Roy A. Carpenter  
Box 623, 416 Longshore Drive  
AC 313-446-1779

New York, N.Y. 10017—Mitchell Hessler  
John C. Jones, Franklin D. Hunt, Dan Ameri  
can Bldg., Room 200, 220 Park Avenue  
AC 212-686-6428

Los Angeles, Calif. 90005—Jens M. Laughlin  
711 South Vermont Avenue  
AC 213-484-1777

Chicago, Ill. 60646—Jim Didier, Jack  
Boudreau, Tom Jones, 4001 West Sunset  
AC 312-446-1779

**Postal Information:** Accepted as second-class circulation publication and postpaid at Chicago, Ill., and at Ann Arbor, Mich. Form 3547 should be sent to Ann Arbor, Mich.